FINAL

HOUSE DUST REMEDIATION REPORT FOR THE BUNKER HILL CERCLA SITE POPULATED AREAS RI/FS

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Prepared for

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3.5.1 HOME VACUUM GRAB SAMPLE DATA SUMMARY

For home vacuum grab sample data, the highest average antimony, arsenic, and lead were found in Zone E, Kellogg. Cadmium was slightly higher on average in Zone B (Smelterville), copper highest in Zone F (Kellogg), and zinc highest on average in Zone I (Page). Comparing average lead and zinc values for each of the zones, the lead to zinc ratio is nearly 1.0 for Zones A, B, C, D, and F. In Zone E, the lead average is more than four times greater than the zinc average, although, if the maximum value of 52,700 mg/kg is removed from the data set, the average lead concentration drops to 1,831 mg/kg, very comparable to the 1,549 mg/kg zinc average. For Zones G (Wardner), H (Pinehurst), and I (Page), the ratio is reversed with zinc concentrations being greater on average than lead concentrations. In these zones, the average zinc concentration is at least two times greater than the average lead concentration. This reversal in ratios of lead to zinc suggests a different contamination source in Kellogg and Smelterville than in Wardner, Pinehurst, and Page.

3.5.2 HOME HANDHELD VACUUM DATA SUMMARY

In comparing data from special vacuum sample analysis (Table 3-11) to sample data from home vacuum grab samples (Table 3-10), the data generated from the special vacuum are higher, with few exceptions. The special vacuum sample collects dust on a 0.45 micron filter while the homeowner vacuum sample is a portion of the dust passing an 80-mesh sieve. The two sampling techniques collect different particle size fractions because of their air flow and filtration characteristics.

Comparing average concentrations between zones, the highest average antimony is in Zone C, the highest arsenic and lead are in Zone B, highest cadmium is in Elizabeth Park, highest copper is in Zone I, and the highest zinc is in Zone E. This apparent greater variability in zones with highest average metal concentrations (as compared to

homeowner vacuum sample data) may be an indication that the sample collection technique is collecting a different type of sample than the homeowner vacuum sample. In all zones the average zinc concentration is at least twice the average lead concentration. This is another indication that the special vacuum is collecting a much different type of sample than the homeowner vacuum.

3.5.3 ATTIC DUST DATA SUMMARY

Summary statistics for attic dust samples collected in 1988 are presented in Table 3-12. Samples were collected from an otherwise unused attic area using the handheld vacuum in a fashion similar to that used for the house dust samples. Because of fewer data points, the data are grouped into three general locations: Smelterville, Kellogg, and Wardner/Page. The highest average antimony, arsenic, lead, and zinc were found in Kellogg. The highest average copper and cadmium were found in Smelterville. In the Kellogg and Wardner/Page areas, the zinc average was greater than the lead average. In Smelterville, this relationship was reversed.

Comparing results of handheld vacuum home samples (Table 3-11) to attic samples (Table 3-12), the average values tend to be higher in the attic samples. It is assumed that attic dust contains high levels of contaminants from historical air emissions from the smelter complex and windblown dust events. Some of this dust may have been removed from house interiors by normal cleaning. This cleaning combined with dilution resulting from tracking less contaminated soil into the home may account for the lower concentration in house interiors. Contaminant concentrations are higher in the Kellogg area, directly downwind from the smelter complex and the Central Impoundment Area (CIA) than in Smelterville.

3.5.4 CONCLUSIONS

Samples collected from homeowner vacuums yield data different from samples collected by the handheld vacuum. Samples collected from the handheld vacuum tend to yield higher metals concentration data.

Data collected in 1988 and 1989 indicate excessive levels of contaminants in residential homes within the Populated Areas of the site using the 500 to 1,000 µg/gm lead cleanup advisory indicated in the RADER (U.S. EPA, 1990c). Samples collected using the handheld vacuum exceeded 500 µg/gm for 96.9 percent of the samples and 1,000 µg/gm for 79.3 percent of the samples. Samples collected from homeowner vacuum cleaners exceeded 500 µg/gm for 87.0 percent of the samples and 62.0 percent of the samples exceeded 1,000 µg/gm.

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Table 3-11 (page 1 of 2)
Home Handheld Vacuum Data
(All Data in Mg/Kg)
Data from Zones A through G and I Collected in 1988
Data from Zone H and Elizabeth Park Collected in 1989

Zone	Statistic	Sb	As	Cd	Cu	Pb	Zn
A	Average	23.8	55.4	23.7	201	1,894	5,350
	Minimum	9.3	27.6	13.3	74.7	985	4,000
	Maximum	41.5	110.0	34.8	476	2,570	8,310
	95 Percentile	38.7	97.1	32.6	410	2,536	7,584
	Geo. Mean	20.6	48.0	22.4	154	1,771	5,118
	No. of Samples	4	4	4	4	4	4
B	Average	42.3	64.9	65.7	212	4,162	8,864
	Minimum	24.0	38.2	24.4	127	2,130	3,500
	Maximum	70.9	107	161	378	9,830	26,700
	95 Percentile	66.3	105	137	365	8,235	18,808
	Geo. Mean	39.6	60.7	52.9	197	3,578	7,299
	No. of Samples	9	9	9	9	9	9
C	Average	137	36.5	22.3	134	1,672	6,583
	Minimum	6.3	13.4	10.4	74.8	818	1,970
	Maximum	1,500	54.5	32.7	215	3,350	15,200
	95 Percentile	542	54.0	31.7	189	2,888	13,590
	Geo. Mean	32.9	34.3	21.2	130	1,536	5,514
	No. of Samples	14	14	14	14	14	14
D	Average	25.5	33.2	30.8	196	2,094	8,331
	Minimum	12.4	14.4	17.5	123	1,390	2,920
	Maximum	39.9	69.3	77.6	305	4,550	20,200
	95 Percentile	37.2	57.6	64.5	292	3,689	17,890
	Geo. Mean	24.1	29.8	26.3	186	1,922	6,397
	No. of Samples	7	7	7	7	7	7
E	Average	136	47.7	22.6	158	2,061	17,011
	Minimum	15.7	14.8	12.0	80.5	840	2,970
	Maximum	1,060	109	43.7	212	3,760	58,300
	95 Percentile	518	91.7	36.7	211	3,678	55,700
	Geo. Mean	52.0	39.3	20.7	152	1,850	10,724
	No. of Samples	11	11	11	11	11	11
F	Average	33.5	38.4	23.3	186	2,598	11,889
	Minimum	12.5	13.6	14.3	93.0	1,850	5,010
	Maximum	51.2	52.9	33.2	397	3,660	30,700
	95 Percentile	49.8	52.8	32.9	304	3,320	24,050
	Geo. Mean	31.2	36.1	22.5	172	2,544	10,148
	No. of Samples	10	10	10	10	10	10

Compare with Table 3-10

Table 3-10 (page 1 of 2)
Home Vacuum Grab Sample Data
(All Data in Mg/Kg)
Data from Zones A through G and I Collected in 1988
Data from Zone H and Elizabeth Park Collected in 1989

Zone	Statistic	Sb	As	Cd	Cu	Pb	Zn
A	Average	18.8	40.1	12.5	828	996	1,250
	Minimum	7.7	13.5	8.5	54.6	553	634
	Maximum	45.5	120	19.9	3,360	1,880	1,880
	95 Percentile	38.0	96.8	18.0	2,659	1,656	1,870
	Geo. Mean	15.4	28	12.0	236	904	1,138
	No. of Samples	5	5	5	5	5	5
B	Average	27.1	30.0	22.9	258	1,900	2,083
	Minimum	3.8	5.4	3.8	39.6	209	340
	Maximum	71.9	71.1	72.1	1,060	4,640	7,060
	95 Percentile	63.1	61.8	53.8	728	4,185	4,674
	Geo. Mean	21.0	24.3	16.6	175	1,372	1,565
	No. of Samples	13	13	13	13	13	13
C	Average	38.8	30.3	18.9	351	1,384	1,666
	Minimum	9.8	3.0	4.0	70.1	228	140
	Maximum	179	49.4	35.1	3,130	2,680	4,300
	95 Percentile	110	46.4	31.2	912	2,520	2,972
	Geo. Mean	26.7	26.5	17.2	180	1,575	1,378
	No. of Samples	16	16	16	16	16	16
D	Average	52.2	40.3	15.3	183	1,253	1,568
	Minimum	4.6	11.6	10.4	78.2	698	759
	Maximum	224	168	20.4	463	1,780	4,400
	95 Percentile	161	120	20.0	390	1,748	3,438
	Geo. Mean	27.7	25.0	14.9	152	1,196	1,279
	No. of Samples	7	7	7	7	7	7
E	Average	282	93.4	22.8	158	6,456	1,549
	Minimum	13.7	10.3	1.7	15.3	93.6	122
	Maximum	2,780	654	43.4	276	52,700	2,530
	95 Percentile	1,305	352	41.1	267	25,783	2,255
	Geo. Mean	41.6	41.3	17.4	131	2,442	1,300
	No. of Samples	11	11	11	11	11	11
F	Average	24.7	26.2	20.3	3,464	2,209	2,057
	Minimum	11.2	6.5	4.2	72.6	441	844
	Maximum	81.2	58.5	50.9	46,400	11,600	4,450
	95 Percentile	34.9	51.5	47.9	14,171	6,028	4,324
	Geo. Mean	20.8	21.8	16.2	218	1,485	1,828
	No. of Samples	14	14	14	14	14	14

Compare with ... on Hill

The Butte-Silver Bow
Environmental Health Lead Study

Butte-Silver Bow Department of Health

Department of Environmental Health
University of Cincinnati

Final Report

August 12, 1991

levels of metal contaminants. One exception was a playground in Area C which is badly contaminated with arsenic from tailings and concentrate probably from the former Colorado Smelter site which was located immediately east of Area C. This area will be remediated in the summer of 1991. Several moderately contaminated soil sites were identified at local daycare centers as well as one center with high lead in exterior paint.

In addition to the routine samples collected at each residence, three additional types of dust samples were collected from the 10 percent random sample of homes that were used as part of this study's quality control plan. These samples were a) dust from the home owners vacuum sweeper, b) dust collected from the attic in those cases where access was possible and c) dustfall collected in a standard container located on top of the refrigerator. Dustfall was measured as both a concentration (ppm) and as a rate of lead fallout (mg $Pb/m^2/30$ days). The purpose of collecting these samples was to derive additional information about the dust lead exposure pathway. The lead content found in these samples is summarized in Table 5.5-32 along with results from street dust, exterior entry dust and floor dust from the same homes. The concentration of lead recovered from residential vacuum sweeper bags was about 50 percent lower and more variable than that measured in samples collected with the standardized vacuuming procedure used in this study. Results are displayed in Figure 5.5-1. Two vacuum sweeper bag samples were markedly lower in lead content and were excluded from the regression analysis shown in Figure 5.5-1. The results of this comparison indicate that the standard method, which measures readily available dust on both carpeted and non-carpeted surfaces, is capturing lead particles with a higher lead content or dust less diluted with non-lead containing particles. The higher inter-residential variability in vacuum sweeper bag dust (G.S.D. = 2.31 versus

G.S.D. = 1.82) is probably a reflection of differences in efficiency of different vacuum sweeper models (see CH2M Hill, 1991). In addition, the areas swept and the timeframe during which dust was collected are undefined in residential vacuum sweeper bags. Body et al (1988), as part of the Port Pirie lead study, reported that 62 percent of the particles recovered from vacuum sweeper bags were greater than 100 microns in diameter, whereas, 87 percent of carpet dust particles were less than 50 microns in diameter. This supports the contention that residential vacuum sweepers are inefficient at sampling lead in carpet dust. The lead content of attic dust samples were on average twice as high as floor dust. The source of this dust is unknown, but is probably derived from air lead from past industrial operations, automotive emissions and wood and coal burning. Attic dust concentrations were not correlated with any other dust lead concentrations. This suggests that this lead level is not a current source of contamination in the house but rather a historical exposure indicator. It could pose problems during house remodelling activities if precautions are not taken. The dust fall concentrations were found to be lower than, and unrelated to, floor dust concentrations. Average dustfall rates were also found to be low, (0.037 mg Pb/m^2/30 days). This rate is comparable to that found in well maintained urban post WWII housing (0.035 mg Pb/m^2/30 days) and well below that found in deteriorated 19th century housing (0.199 mg Pb/m^2/30 days). See Clark et al, 1991 (in press) for comparable urban data.

5.6 Risk Modifiers

Interviews were conducted with the parents to determine the nature and extent of children's behaviors, parents' activities or other factors which might increase or decrease the impact of environmental lead on children's blood lead.

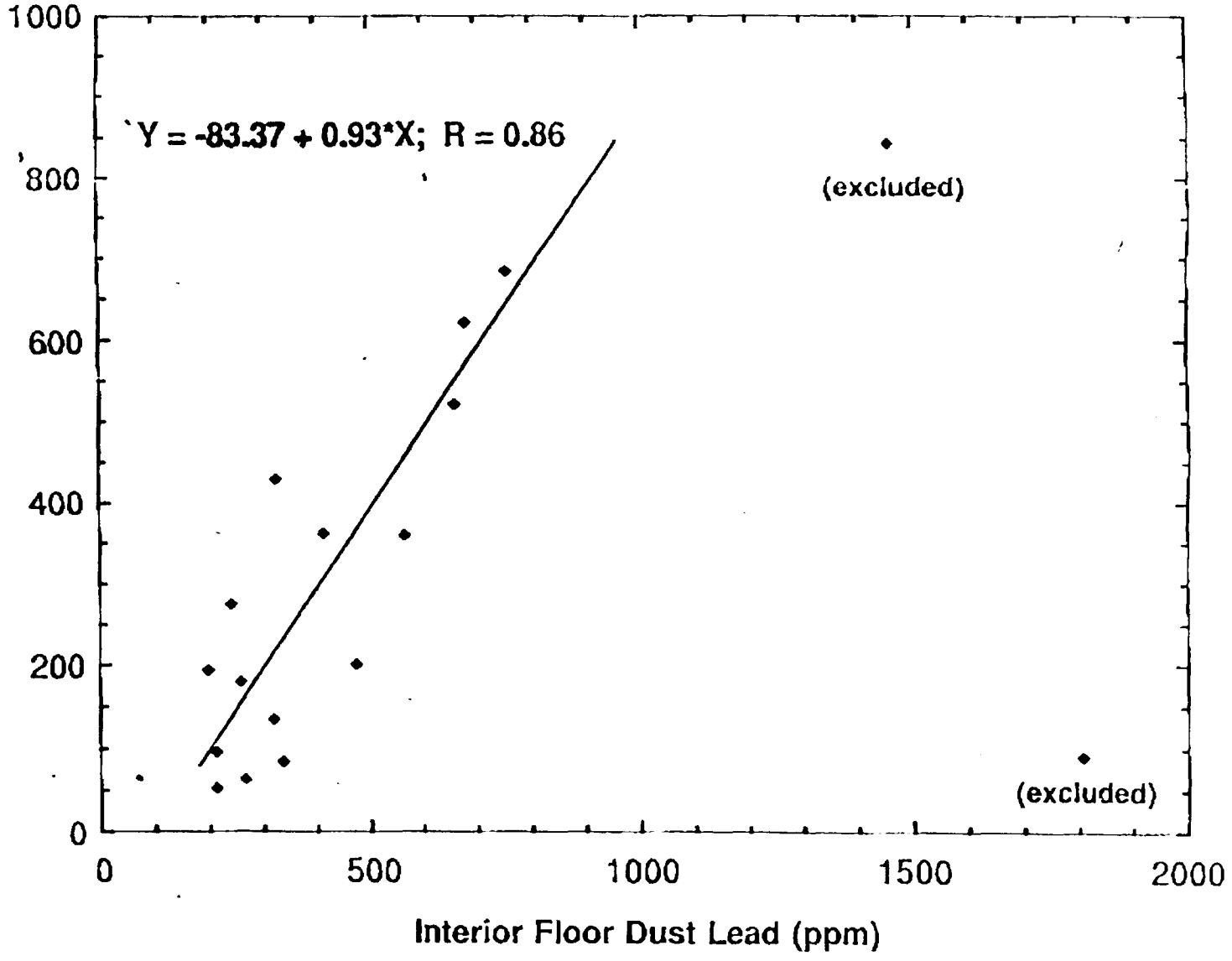
Y = -83.37 + 0.93*X; R = 0.86
(excluded)
(excluded)
1000
800
600
400
200
0
0
500
1000
1500
2000
Interior Floor Dust Lead (ppm)

Table 5.5-32

Lead in Special Dust Samples

	Street Dust (ppm)	Exterior Entry (ppm)	Interior Floor (ppm)	Vacuum Cleaner Bag (ppm)	Dustfall (ppm)	Dustfall (mg/m^2/ 30 days)	Attic (ppm)
N	18	18	20	18	19	19	6
Geo. Mean	164	333	416	223	244	.037	834
G.S.D.	2.02	3.04	1.83	2.31	1.86	2.62	2.01
Range	38-429	55-1669	199-1807	55-845	41-519	.005-.222	295-1632

compare

Butte